

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

FRANS LODEWIJK PLANTENGA, ET AL.)

APPN. NO.: 10/728,489)

FILED: December 5, 2003)

Heavy Feed HPC Process Using A)
Mixture Of Catalysts)

GROUP ART UNIT: 1797

CONFIRMATION NO.: 9745

EXAMINER: Nguyen, Tam M.

Commissioner for Patents
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BRIEF ON APPEAL

Sir:

CERTIFICATE OF SUBMISSION

I hereby certify that, in the course of ordinary business, this paper (along with any that may be referred to as being attached or otherwise included with this submission) is being submitted on the date indicated below to the United States Patent and Trademark Office via EFS-Web.

13 - October - 2010

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SARAH MARSHIK

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REAL PARTY IN INTEREST

The real party in interest for this appeal is Albemarle Netherlands B.V., an entity duly organized and existing under the laws of The Netherlands, having a place of business at Nieuwendammerkade 1-3, NL-1022 AB Amsterdam, The Netherlands.

RELATED APPEALS AND INTERFERENCES

There are presently no appeals or interferences, known to Appellants, Appellants' representatives or the Assignee, which may be related to, directly affect, or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1 to 10 are pending in this appeal. All pending Claims 1 to 10 are being appealed.
The pending Claims are reproduced in the Claims Appendix attached hereto.

STATUS OF AMENDMENTS

No amendments were filed with or subsequent to the final rejection and the Examiner has entered the Claims listed in the appendix.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a process for hydroprocessing a heavy hydrocarbon oil involving contacting a heavy hydrocarbon oil in the presence of hydrogen with a mixture of hydroprocessing catalyst I and hydroprocessing catalyst II, see page 4, lines 11-19. Catalyst I comprises a Group VIB metal and optionally a Group VIII metal on a porous inorganic carrier, see page 5, lines 4-16. Catalyst I is further described as having a specific surface area of at least $100\text{m}^2/\text{g}$, a total pore volume of at least 0.55ml/g , and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 50% of the total pore volume in pores with a diameter of at least 20nm (200\AA), and 10-30% of the total pore volume in pores with a diameter of at least 200nm (2000\AA), see page 5, lines 4-30. Catalyst II comprises a Group VIB metal and optionally a Group VIII metal on a porous inorganic carrier, see page 5, lines 4-16. Catalyst II is further described as having a specific surface area of at least $100\text{m}^2/\text{g}$, a total pore volume of at least 0.55ml/g , and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 75% of the total pore volume in pores with a diameter of $10\text{-}120\text{nm}$ ($100\text{-}1200\text{\AA}$), 0-2% of the total pore volume in pores with a diameter of at least 400nm (4000\AA), and 0-1% of the total pore volume in pores with a diameter of at least 1000nm (10000\AA), see page 8, lines 7-28.

The present invention also relates to the combination of Catalyst I and Catalyst II. Catalyst I comprises a Group VIB metal and optionally a Group VIII metal on a porous inorganic carrier, see page 5, lines 4-16. Catalyst I is further described as having a specific surface area of at least $100\text{m}^2/\text{g}$, a total pore volume of at least 0.55ml/g , and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 50% of the total pore volume in pores with a diameter of at least 20nm (200\AA), and 10-30% of the total pore volume in pores with a diameter of at least 200nm (2000\AA), see page 5, lines 4-30. Catalyst II comprises a Group VIB metal and optionally a Group VIII metal on a porous inorganic carrier, see page 5, lines 4-16. Catalyst II is further described as having a specific surface area of at least $100\text{m}^2/\text{g}$, a total pore volume of at least 0.55ml/g , and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 75% of the total pore volume in pores with a diameter of $10\text{-}120\text{nm}$ ($100\text{-}1200\text{\AA}$), 0-2% of the total pore volume in pores with a diameter of at least 400nm (4000\AA), and 0-1% of the total pore volume in pores with a diameter of at least 1000nm (10000\AA), see page 8, lines 7-28.

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-10 have been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler"). The Examiner continues to describe the reasons for rejection of the individual claims, and applicants will address these rejections in the order listed in the office action for completeness.

ARGUMENT

I. FIRST REJECTION UNDER 35 U.S.C. 103

Claim 1 has been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler").

EXAMINER'S POSITION

The Examiner takes the position that Clark discloses a process for the hydroconversion of a heavy hydrocarbon feed in the presence of a catalyst mixture containing two catalysts that each contain Group VIB and VIII metals on a porous inorganic support and where the second catalyst has an average pore diameter of 20nm. Also Clark discloses that the second catalyst can be unimodal, and the Examiner thus takes the position that the second catalyst would be in the mesopore range having an average pore diameter of 20nm. The Examiner repeats this position in the Advisory Action

The Examiner notes that Clark does not disclose that the first catalyst has a surface area of at least $100\text{m}^2/\text{g}$, a total pore volume of at least 0.55ml/g , at least 50% of the total pore volume in pores with a diameter of at least 20nm and 10-30% of the total pore volume in pores with a diameter of at least 200nm. Further, the Examiner notes that Clark does not disclose that the pore size distribution is for inhibiting sediment formation.

The Examiner also takes the position that Schindler disclose a catalyst with a surface area of $125\text{m}^2/\text{g}$, a total pore volume from 0.75 to 0.95cc/g , about 60% of the total pore volume in pores with at least 25nm and 21% of the total pore volume in pores with a diameter of at least 150nm. Also the Examiner takes the position that the Table at column 1 of Schindler make optional that the pore volume of the catalyst to be in pores greater than 25nm.

Thus, the Examiner takes the position that it would have been obvious to one having ordinary skill in the art at the time of the invention to modify the process of Clark to include a catalyst with a surface area of $125\text{m}^2/\text{g}$, a total pore volume from 0.75 to 0.95cc/g , about 60% of the total pore volume in pores with at least 25nm and 21% of the total pore volume in pores with a diameter of at least 150nm.

The Examiner states that the amendment to the claims adding that the pores size distribution is for inhibiting sediment formation does not further limit the claims because such language is functional language, and is thus limited only by the steps of the claims, citing MPEP

2184 III.

APPLICANTS' POSITION

Applicants respectfully disagree with the Examiner, and applicants take the position that the present invention is not obvious in light of the teachings of Clark in light of Schindler.

The present invention embodied by claim 1 relates to a process for hydroprocessing a heavy hydrocarbon oil involving contacting a heavy hydrocarbon oil in the presence of hydrogen with a mixture of hydroprocessing catalyst I and hydroprocessing catalyst II. Catalyst I comprises a Group VIB metal and optionally a Group VIII metal on a porous inorganic carrier. Catalyst I is further described as having a specific surface area of at least 100m²/g, a total pore volume of at least 0.55ml/g, and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 50% of the total pore volume in pores with a diameter of at least 20nm (200Å), and 10-30% of the total pore volume in pores with a diameter of at least 200nm (2000Å). Catalyst II comprises a Group VIB metal and optionally a Group VIII metal on a porous inorganic carrier. Catalyst II is further described as having a specific surface area of at least 100m²/g, a total pore volume of at least 0.55ml/g, and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 75% of the total pore volume in pores with a diameter of 10-120nm (100-1200Å), 0-2% of the total pore volume in pores with a diameter of at least 400nm (4000Å), and 0-1% of the total pore volume in pores with a diameter of at least 1000nm (10000Å). The present invention also relates to the combination of catalyst I and catalyst II.

Clark in its broadest disclosure teaches the use of a two-catalyst system wherein the first catalyst has relatively small pores and the second catalyst has relatively large pores. The first catalyst composition comprises a porous refractory inorganic oxide and possesses a pore volume of less than about 0.10 cc/g in pores having a diameter of greater than about 200Å, a pore volume of less than about 0.02 cc/g in pores having a diameter greater than about 800Å, and a maximum average mesopore diameter of about 130Å, wherein mesopores are broadly defined as pores having diameters in the range of from about 50Å to about 300Å. The second catalyst composition comprises a porous refractory inorganic oxide and possesses a pore volume of greater than about 0.07cc/g in pores having a diameter greater than 800Å. See col. 9, line 60 through col. 10, line 11 of Clark.

Schindler teaches a single catalyst that is useful for hydrotreating feedstocks such as those described at col. 2, lines 24-37 of Schindler. The catalyst is described as containing catalytically effective amounts of nickel and molybdenum supported on alumina wherein the catalyst has a

total porosity of at least 0.5cc/g, and most generally from 0.75 to 0.95cc/g, and a pore size distribution as defined in the table in column 1, see col.1, lines 16-33 of Schindler.

While the Examiner contends that including a catalyst such as the type disclosed in Schindler as the first catalyst in Clark would obviate the present invention, applicants respectfully disagree. Applicants take the position that the combination of the second catalyst of Clark with the teachings of Schindler is improper. The teachings of Clark expressly state that the "first catalyst is essentially unimodal since it has no appreciable macropore volume", see Clark, col. 10, lines 15-16. Clark defines mesopores as having diameters ranging from about 50 Angstroms to about 300 Angstroms, see Clark, col. 10, lines 5-7. Thus, by the teachings of Clark, any pore having a diameter of above about 300 Angstrom would be a macropore, i.e. those pores larger than mesopores. The catalyst of Schindler with which the Examiner seeks to substitute for the first catalyst of Clark contains a large amount of its pores in this macropore range, greater than about 0.28cc/g to greater than about 0.55cc/g, of a total pore volume of 0.63 to about 1.2cc/g, according to the Table located at col. 1, lines 25-30 of Schindler. Thus, the catalyst of Schindler appears to be at least a bimodal catalyst, by the definitions of Clark itself since the Schindler catalyst clearly has an appreciable macropore volume. One having ordinary skill in the art would not find it obvious to combine the teachings of a reference that requires that the first catalyst be essentially unimodal (Clark), with the teachings of another reference that teaches that the first catalyst is at least bi-modal (Schindler). One would not be able to determine the operation of such a process.

One having ordinary skill in the art would also not modify the teachings of Clark with Schindler because the Clark reference clearly states that the first catalyst "has no appreciable macropore volume", see Clark, col. 10, lines 15-16, and the Schindler catalyst has at least about 40% of its pores within the macropore region, see above discussion regarding catalyst of Schindler and the Table at col. 1, lines 25-30 of Schindler.

In addition, the teachings of Clark note that problems of the prior art are solved by their invention by using a first catalyst having relatively small pores and a second catalyst having relatively large pores. To combine the teachings of Schindler with those of Clark and use the catalyst of Schindler as the first catalyst of Clark would mean that the two catalysts used in the process of Clark would both have relatively large pores. In fact, the catalyst of Schindler actually has pore volumes even larger than those of the second catalyst of Clark. By making such a combination, one would be completely outside the teachings of Clark because there would be no catalyst that satisfies the limitations of the small pore catalyst, i.e. first catalyst, which is a clear

requirement of the Clark invention. Thus, one having ordinary skill in the art would not even be motivated to try such a combination because this combination is contradictory to the teachings of Clark.

Applicants also respectfully submit that combining the teachings of Schindler with those of Clark would likely not overcome the shortcomings of the prior art solved by the Clark invention. Clark teaches that it is only with the combination of a small pore catalyst with a large pore catalyst that the problems with the prior art are overcome. However, to combine the teachings of Schindler with those of Clark would completely exclude this small pore catalyst, as discussed above. In fact, the catalyst of Schindler actually has pore volumes even larger than those of the second catalyst of Clark, and the problems of the prior art pointed out by Clark in col. 9, lines 19-26, e.g. more rapid conversion and therefore poorer solvent properties, could increase because of the lack of the small pore first catalyst. Thus, one having ordinary skill in the art would not even be motivated to try such a combination.

Applicants do not concede that the combination of the catalyst of Schindler as the first Catalyst in Clark is proper, but applicants will address this combination as proper for the sake of completeness. Applicants respectfully submit that even if one were to combine these teachings one would not arrive at the present invention. Clark does not teach, disclose, or suggest that at least 75% of the pore total pore volume of the second catalyst is in pores having a diameter of 10-120nm (100-1200Å). The Examiner contends both in the Advisory Action and the Final Office Action that Clark teaches that the second catalyst of Clark can be unimodal, and that the set pore size would be 20nm(200Angstrom). Applicants respectfully submit that the Examiner is not reading the entire disclosure of Clark. Applicants do not dispute that Clark discloses that the second catalyst can be unimodal, see col. 10, lines 15-16. However, Clark also notes that the second catalyst must have the requisite amount of macropore volume, whether it is bimodal or unimodal, see Clark, col. 10, lines 12-14. The requisites for the macropore volume of the second catalyst are provided at col. 10, lines 10-11, wherein it is stated that the second catalyst has greater than about 0.07cc/g in pores having a diameter of greater than 800Angstroms. Thus, there is no way to conclude or support the Examiner's statements that the second catalyst of Clark has all of its pores within the mesopore region having an average diameter of 20nm because to do so expressly ignores the statements of Clark concerning the macropore region. Thus, even if the catalyst were unimodal, Clark does not provide the requisite teaching that at least 75% of the pore total pore volume of the second catalyst is in pores having a diameter of 10-120nm (100-1200Å).

Applicants also respectfully disagree with the examiner that the second catalyst of Clark satisfies the limitations of Catalyst II of the present invention that at least 75% of the pore total pore volume of the second catalyst is in pores having a diameter of 10-120nm (100-1200Å). The pore size of the first and second catalysts of Clark are discussed in Clark at col. 10, lines 1-37. In this section, Clark first broadly discloses the pore volume of the second catalyst and then makes increased limitations with regards to the mesopore and macropore range when discussing preferred embodiments. In its broadest sense, the second catalyst of Clark simply has greater than about 0.07cc/g of the pore volume in pores having a diameter of greater than 800Angstrom. Applicants respectfully submit that there is no way to tell anything about the pore range of 10-120nm (100-1200Å), as is presently claimed from this disclosure. In the first preferred embodiment, discussed at col. 10, lines 17-25, the second catalyst is described as having an average mesopore diameter ranging from about 60 to about 200Angstroms coupled with a macropore volume of greater than about 0.1cc/g in pores having diameters greater than about 800Angstrom. In the most preferred embodiment, the second catalyst is further described as having an average mesopore diameter ranging from about 60 to about 180Angstroms coupled with a macropore volume of greater than about 0.1cc/g in pores having diameters greater than about 1200Angstrom. Again, there is no way to tell anything about the pore range of 10-120nm (100-1200Å), as is presently claimed from this disclosure. It would not have been obvious to modify the teachings of Schindler to include such pore size distributions, and to do so can only be accomplished through the use of improper hindsight using the present application as the basis for such modification.

The present claims also include the limitation that catalyst II has a total pore volume of greater than 0.55ml/g. Clark is completely silent as to the total pore volume of the catalysts used therein.

The present claims also include the limitation that catalyst II has less than 25% of its total pore volume in pores of a diameter of 10 nm (100 Å) or less. Clark is completely silent as to this limitation.

Applicants are also unsure as to the Examiner's conclusions concerning the catalyst of Schindler and how these are even applicable to present catalyst I. Present catalyst I is described as having a specific surface area of at least 100 m²/g, a total pore volume of at least 0.55 ml/g, at least 50% of the total pore volume in pores with a diameter of at least 20 nm (200 Å), and 10-30% of the total pore volume in pores with a diameter of at least 200 nm (2000 Å). In the Examiner's rejection in the final office action, the Examiner states that it would have been

obvious to use as the first catalyst in Clark “...a catalyst with a surface area of 125m²/g, a total pore volume from 0.75cc/g to 0.95cc/g, about 60% of the total pore volume in pores with at least 25nm and 21% of the total pore volume in pores with a diameter of at least 150nm...”

Applicants must request clarification on how these limitations are applicable to the present claims and catalyst I. The present claims contain no limitations with regards to pores having a diameter of 150nm. It appears that the Examiner is trying to use the teaching of 21% of the total pore volume in pores with a diameter of at least 150nm to satisfy the present limitation of 10-30% of the total pore volume in pores with a diameter of at least 200 nm (2000 Å). This is incorrect and not possible to draw these conclusions, and one having ordinary skill in the art would clearly understand that a pore size distribution having 21% of its pores in diameters of 150nm does not satisfy and is not an obvious variant of a pore size distribution wherein 10-30% of the total pore volume in pores with a diameter of at least 200 nm (2000Å), as is presently claimed.

In addition, the present claims contain no limitations with regards to the total pore volume in pores of 25nm. It appears that the Examiner is trying to use the teaching of about 60% of the total pore volume in pores with at least 25nm to satisfy the present limitation of at least 50% of the total pore volume in pores with a diameter of at least 20 nm (200 Å). This is incorrect and not possible to draw these conclusions, and one having ordinary skill in the art would clearly understand that a pore size distribution having 60% of its pores in diameters of 250nm does not satisfy and is not an obvious variant of a pore size distribution wherein at least 50% of the total pore volume in pores with a diameter of at least 20 nm (200Å), as is presently claimed.

Thus, even if one were to combine the teachings of Clark with Schindler, one would still not be taught the present invention as is presently claimed because one would lack the teaching to use the first and second catalyst necessary in the present invention.

While the Examiner has accepted applicants' arguments regarding the functional language present in the claims in the Advisory Action, applicants present their arguments here again for completeness. Applicants also respectfully disagree with the Examiner concerning the use of the functional language in the claims, and applicants respectfully point the Examiner to MPEP 2173.05(g). Based on MPEP 2173.05(g), applicants respectfully submit that the limitations in the claims that the pore size distribution of the first catalyst is selected for inhibiting sediment formation and promoting asphaltene removal and the pore size distribution of the second catalyst is selected for providing catalytic activity are perfectly acceptable and set definite boundaries for the patent protection sought. That being said, applicants submit that neither Clark, Schindler, nor

any combination thereof, provides teachings to arrive at a process using a catalyst combination or catalyst combination itself wherein the pore size distribution of the first catalyst is selected to promote asphaltene removal and inhibit sediment formation and the pore size distribution of the second catalyst is selected to provide catalytic activity, as is presently claimed.

It is thus requested that these rejections be reconsidered and withdrawn

II. SECOND REJECTION UNDER 35 U.S.C. 103

Claims 2-4 have been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler").

EXAMINER'S POSITION

The Examiner takes the position that Claims 2-4 are obvious in light of the teachings of Clark in combination with Schindler for the reasons noted on pages 4 and 5 of the Office Action.

APPLICANTS' POSITION

Applicants respectfully disagree with the Examiner, and applicants take the position that Claims 2-4 are not obvious in light of the teachings of Clark in light of Schindler. Claims 2-4 are dependent claims and by definition include all of the limitations of the claims from which they depend. Therefore, claims 2-4 include all of the limitations of novel, independent Claim 1, and are therefore novel for, among other reasons, the reasons discussed above.

It is thus requested that these rejections be reconsidered and withdrawn

III. THIRD REJECTION UNDER 35 U.S.C. 103

Claim 5 has been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler").

EXAMINER'S POSITION

The Examiner takes the position that Claim 5 is obvious in light of the teachings of Clark in combination with Schindler for the reasons noted on page 5 of the Office Action.

APPLICANTS' POSITION

Applicants respectfully disagree with the Examiner, and applicants take the position that Claim 5 is not obvious in light of the teachings of Clark in light of Schindler. Claim 5 is a dependent claim and by definition includes all of the limitations of the claims from which it depends. Therefore, claim 5 includes all of the limitations of novel, independent Claim 1, and is therefore novel for, among other reasons, the reasons discussed above.

It is thus requested that these rejections be reconsidered and withdrawn

IV. FOURTH REJECTION UNDER 35 U.S.C. 103

Claim 6 has been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler").

EXAMINER'S POSITION

The Examiner takes the position that Claim 6 is obvious in light of the teachings of Clark in combination with Schindler for the reasons noted on page 5 of the Office Action.

APPLICANTS' POSITION

Applicants respectfully disagree with the Examiner, and applicants take the position that Claim 6 is not obvious in light of the teachings of Clark in light of Schindler. Claim 6 is a dependent claim and by definition includes all of the limitations of the claims from which it depends. Therefore, claim 6 includes all of the limitations of novel, independent Claim 1, and is therefore novel for, among other reasons, the reasons discussed above.

It is thus requested that these rejections be reconsidered and withdrawn.

V. FIFTH REJECTION UNDER 35 U.S.C. 103

Claim 7 has been rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler").

EXAMINER'S POSITION

The Examiner takes the position that Claim 7 is obvious in light of the teachings of Clark in combination with Schindler for the reasons noted on pages 5-7 of the Office Action. In short, the Examiner has rejected Claim 7 for the same reasons discussed above in relation to the First Rejection under 103(a).

APPLICANTS' POSITION

Applicants respectfully disagree with the Examiner, and applicants take the position that Claim 7 is not obvious in light of the teachings of Clark in light of Schindler for the same reasons discussed above in the First Rejection under 103(a), and applicants restate all arguments presented in the First Rejection under 103(a). In short, the combination of Schindler and Clark is improper, and even if such combination were proper, the limitations of catalyst I and catalyst II in claim 7 are not satisfied or rendered obvious by such a combination.

It is thus requested that these rejections be reconsidered and withdrawn

VI. SIXTH REJECTION UNDER 35 U.S.C. 103

Claims 8-10 have been rejected under 35 U.S.C. 103(a) as being unpatentable over United

States Patent Number 5,100,855, Clark, et al. ("Clark") in view of United States Patent Number 4,414,414, Schindler ("Schindler").

EXAMINER'S POSITION

The Examiner takes the position that Claims 8-10 are obvious in light of the teachings of Clark in combination with Schindler for the reasons noted on pages 7-8 of the Office Action.

APPLICANTS' POSITION

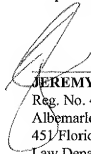
Applicants respectfully disagree with the Examiner, and applicants take the position that Claims 8-10 are not obvious in light of the teachings of Clark in light of Schindler. Claims 8-10 are dependent claims and by definition include all of the limitations of the claims from which they depend. Therefore, claims 8-10 include all of the limitations of novel, independent Claim 7, and are therefore novel for, among other reasons, the reasons discussed above.

It is thus requested that these rejections be reconsidered and withdrawn

RELIEF REQUESTED

Reversal of all of the rejections in this case, and a finding that the present Claims are allowable over the cited references are respectfully requested.

Respectfully submitted,



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CLAIMS APPENDIX

Claim 1 A process for hydroprocessing a heavy hydrocarbon oil, comprising contacting a heavy hydrocarbon oil in the presence of hydrogen with a mixture of hydroprocessing catalyst I and hydroprocessing catalyst II, wherein

catalyst I comprises a Group VIB metal component and optionally a Group VIII metal component on a porous inorganic carrier, said catalyst having a specific surface area of at least $100 \text{ m}^2/\text{g}$, a total pore volume of at least 0.55 ml/g , at least 50% of the total pore volume in pores with a diameter of at least 20 nm (200 \AA), and 10-30% of the total pore volume in pores with a diameter of at least 200 nm (2000 \AA), and

catalyst II comprises a Group VIB metal component and optionally a Group VIII metal component on a porous inorganic carrier, said catalyst having a specific surface area of at least $100 \text{ m}^2/\text{g}$, a total pore volume of at least 0.55 ml/g , at least 75% of the total pore volume in pores with a diameter of $10\text{-}120 \text{ nm}$ ($100\text{-}1200 \text{ \AA}$), 0-2% of the total pore volume in pores with a diameter of at least 400 nm (4000 \AA), and 0-1 % of the total pore volume in pores with a diameter of at least 1000 nm (10000 \AA); and wherein both catalyst I and catalyst II have less than 25% of their total pore volume in pores of a diameter of 10 nm (100 \AA) or less.

Claim 2 The process of claim 1 wherein catalyst II comprises a catalyst IIa, a catalyst IIb, or a mixture thereof, wherein

catalyst IIa comprises 7 to 20 wt.% of a Group VIB metal component, calculated as trioxide on the weight of the catalyst, and 0.5 to 6 wt.% of a Group VIII metal component, calculated as oxide on the weight of the catalyst, on a porous inorganic carrier, said catalyst having a specific surface area of $100\text{-}180 \text{ m}^2/\text{g}$, a total pore volume of at least 0.55 ml/g , at least 85% of the total pore volume in pores with a diameter of $10\text{-}120 \text{ nm}$ ($100\text{-}1200 \text{ \AA}$), 0-2% of the total pore volume in pores with a diameter of at least 400 nm (4000 \AA), and 0-1 % of the total pore volume in pores with a diameter of at least 1000 nm (10000 \AA) and catalyst IIb comprises 7 to 20 wt.% of a Group VIB metal component, calculated as trioxide on the weight of the catalyst, and 0.5 to 6 wt.% of a Group VIII metal component, calculated as oxide on the weight of the catalyst, on a porous inorganic carrier preferably comprising at least 3.5wt.% of silica, calculated on the weight of the final catalyst, said catalyst having a specific surface area of at least $150 \text{ m}^2/\text{g}$, a total pore volume of at least 0.55 ml/g , at least 75% of the total pore volume

in pores with a diameter of 10-120 nm (100-1200 Å), 0-2% of the total pore volume in pores with a diameter of at least 400 nm (4000 Å), and 0-1 % of the total pore volume in pores with a diameter of at least 1000 nm (10000 Å).

Claim 3 The process of claim 2 wherein catalyst IIb additionally comprises a Group IA metal component and/or a Group VA metal component, in particular phosphorus.

Claim 4 The process of claim 2 wherein a mixture of catalysts IIa and IIb is applied, wherein catalyst IIa has at least 50% of its pore volume in pores with a diameter above 200 Å, and catalyst IIb has at most 50% of its pore volume in pores with a diameter above 200 Å.

Claim 5 The process of claim 1 wherein the heavy hydrocarbon feed of which at least 50 wt.%, preferably at least 80 wt.%, boils above 538°C, and which comprises at least 2 wt.% of sulfur and at least 5 wt.% of Conradson Carbon.

Claim 6 The process of claim 1 which is carried out in an ebullating bed.

Claim 7 A mixture of catalysts comprising a catalyst I which comprises a Group VIB metal component and optionally a Group VIII metal component on a porous inorganic carrier, said catalyst having a specific surface area of at least 100 m²/g, a total pore volume of at least 0.55 ml/g, and a pore size distribution for inhibiting sediment formation and promoting asphaltene removal such that at least 50% of the total pore volume in pores with a diameter of at least 20 nm (200 Å), and 10-30% of the total pore volume in pores with a diameter of at least 200 nm (2000 Å), and a catalyst II which comprises a Group VIB metal component and optionally a Group VIII metal component on a porous inorganic carrier, said catalyst having a specific surface area of at least 100 m²/g, a total pore volume of at least 0.55 ml/g, and a pore size distribution for providing catalytic activity such that at least 75% of the total pore volume in pores with a diameter of 10-120 nm (100-1200 Å), 0-2% of the total pore volume in pores with a diameter of at least 400 nm (4000 Å), and 0-1 % of the total pore volume in pores with a diameter of at least 1000 nm (10000 Å); and wherein both catalyst I and catalyst II have less than 25% of their total pore volume in pores of a diameter of 10 nm (100 Å) or less.

Claim 8 The catalyst mixture of claim 7 wherein catalyst II comprises a catalyst IIa, a catalyst IIb, or a mixture thereof, wherein

catalyst IIa comprises 7 to 20 wt.% of a Group VIB metal component, calculated as trioxide on the weight of the catalyst, and 0.5 to 6 wt.% of a Group VIII metal component, calculated as oxide on the weight of the catalyst, on a porous inorganic carrier, said catalyst having a specific surface area of 100-180 m²/g, a total pore volume of at least 0.55 ml/g, at least 85% of the total pore volume in pores with a diameter of 10-120 nm (100-1200 Å), 0-2% of the total pore volume in pores with a diameter of at least 400 nm (4000 Å), and 0-1 % of the total pore volume in pores with a diameter of at least 1000 nm (10000 Å) and

catalyst IIb comprises 7 to 20 wt.% of a Group VIB metal component, calculated as trioxide on the weight of the catalyst, and 0.5 to 6 wt.% of a Group VIII metal component, calculated as oxide on the weight of the catalyst, on a porous inorganic carrier preferably comprising at least 3.5 wt.% of silica, calculated on the weight of the final catalyst, said catalyst having a specific surface area of at least 150 m²/g, a total pore volume of at least 0.55 ml/g, at least 75% of the total pore volume in pores with a diameter of 10-120 nm (100-1200 Å), 0-2% of the total pore volume in pores with a diameter of at least 400 nm (4000 Å), and 0-1% of the total pore volume in pores with a diameter of at least 1000 nm (10000 Å).

Claim 9 The catalyst mixture of claim 8 wherein catalyst IIb additionally comprises a Group IA metal component and/or a Group VA metal component, in particular phosphorus.

Claim 10 The catalyst mixture of claim 8 wherein a mixture of catalysts IIa and IIb is applied, wherein catalyst IIa has at least 50% of its pore volume in pores with a diameter above 200 Å, and catalyst IIB has at most 50% of its pore volume in pores with a diameter above 200 Å.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None